

# “Test Your Knowledge” Answers

## Chapter 1

1. Daedalus
2. Chinese
3. Chinese
4. f
5. c
6. e
7. b
8. g
9. a
10. d
11. T
12. F
13. T
14. T
15. T
16. F
17. F
18. T
19. T
20. T

## Chapter 2

1. Robert Esnault-Pelterie
2. Alberto Santos-Dumont
3. English Channel
4. Rheims, France
5. Igor Sikorsky
6. heavy
7. e
8. d
9. a
10. b
11. f
12. c
13. F
14. T
15. T
16. F
17. F
18. T
19. F
20. F
21. F
22. F
23. T
24. F
25. T
26. T
27. F
28. T

## Chapter 3

1. Pulitzer Trophy Race
2. Pulitzer Trophy Race
3. Bendix Race
4. Ninety-Nines
5. Woodrow Wilson
6. School of Aeronautics at New York
7. Igor Sikorsky
8. Charles Lindbergh
9. many disasters
10. Treaty of Versailles
11. b
12. c
13. d
14. a
15. F
16. F
17. T
18. T
19. T
20. T
21. T
22. F
23. F
24. F
25. T
26. T
27. F
28. F
29. T
30. T
31. F
32. T
33. T
34. T
35. F
36. T
37. T
38. F
39. T
40. T
41. F
42. T

## Chapter 4

1. Japanese
2. cripple the American fleet
3. increased
4. civil service employees
5. F

6. T
7. F
8. T
9. T
10. F
11. T
12. F
13. F
14. T
15. T
16. T
17. T
18. F
19. F
20. F
21. T
22. F
23. F
24. T
25. T

## Chapter 5

1. T
2. F
3. F
4. F
5. T
6. F
7. T
8. T
9. F
10. F
11. It was the only country possessing the atomic bomb, and it felt secure with that weapon.
12. nuclear deterrence
13. when the Soviet Union prevented any surface transportation in or out of the city
14. North Korean
15. The atomic arsenal was not enough to prevent involvement in war.
16. B-52
17. F-100
18. DeHavilland Comet 1
20. b
21. d
22. e
23. c
24. a
25. French
26. Kennedy

27. Tonkin Gulf Resolution, Johnson
28. Television
29. Tet Offensive
30. Precision guided munitions, smart bombs
31. Rolling Thunder, Linebacker
32. Strategic Air Command (SAC)
33. Civil Reserve Air Fleet (CRAF)
34. KC-135, KC-10
35. command, control
36. The Cold War was defined by the antagonistic and competitive relationship between the former Soviet Union (USSR) and the United States. The USSR's political and economic ideologies were communism and socialism, whereas the US preferred democracy and capitalism. The war was "cold" because the two countries did not directly fight each other with military forces.
37. The Soviets cut off the city of West Berlin from the "free world" in an attempt to make it another Soviet satellite. The U.S. was able to airlift enough supplies to the city so its people could survive. The airlift was so successful that the Soviets ended their siege.
38. Key airpower role in the Korean War included close air support, interdiction, and air superiority.
39. American pilots did so well in the Korean War because they were well trained.
40. WW II improvements to aviation included: better instrumentation, better navigation equipment, better safety devices, and larger airports (just to name a few).
41. As aircraft approaching the sound barrier experienced severe vibrations and control problems.
42. Swept-wings allowed aircraft to fly faster, but landing at high speeds was very dangerous.
43. New missile technology allowed pilots to strike targets far out, making them less susceptible to enemy defensive fire.
44. B-52 bombers and KC-135 tankers extended the range of US nuclear attack capability, The U-2 was used in a reconnaissance role, B-2 bomber (stealth) was designed to elude enemy radar.
45. Unlike Vietnam's Rolling Thunder, where the US gradually escalated hostilities, the Desert Storm strategy was to hit hard and hit fast. Also, the

conduct of Desert Storm was left to the military leaders and not to the President, as was the case with President Johnson during Vietnam. Finally, centralized control and decentralized execution was practiced as a result of lessons learned in the Korean War and during the North African Air Campaign during World War II.

46. Not only did E-8 JSTARS aircraft spot Iraqi tanks moving towards Saudi Arabia, AC-130s demolished the tanks. Air power squashed the Iraqi counterattack.

## Chapter 6

1. T
2. F
3. T
4. T
5. F
6. T
7. T
8. F
9. T
10. T
11. F
12. T
13. XB-70
14. X-15
15. X-15
16. c
17. a
18. b
19. d

## Chapter 7

1. e
2. g
3. a
4. b
5. h
6. d
7. c
8. f
9. leading edge
10. camber (curvature)
11. trailing edge
12. chord (chord line)
13. weight, thrust
14. camber, airfoil
15. stall
16. shock wave
17. maximum gross weight
18. useful load

19. T
20. F
21. T
22. F
23. T
24. F
25. F
26. T
27. T
28. Relative wind or relative motion is the movement of air with enough speed and from a direction that will produce lift as it flows over a wing.29. Airspeed is the rate of speed through the air. Ground speed is the time it takes to fly from A to B over the ground.
30. It will be greater.
31. By streamlining and polishing the airframe.
32. At the speed of sound, a shock wave is encountered which results in lost energy.

## Chapter 8

1. wing
2. flap
3. vertical stabilizer
4. aileron
5. cockpit
6. fuselage
7. elevator
8. rudder
9. horizontal stabilizer
10. lateral (pitch), elevator
11. longitudinal (roll), ailerons
12. vertical (yaw), rudder
13. increases
14. takeoffs, landings
15. protrusion, leading
16. induced
17. laminar, induced
18. airfoil's lift
19. c
20. e
21. a
22. g
23. b
24. f
25. d
26. c
27. a
28. b
29. conventional
30. tricycle
31. tandem
32. Anti-skid brakes prevent brake failure due to overheating and reduce the possibility of sliding on a slippery surface.

33. Fixed gear is less costly to build and maintain; plus the drag caused by fixed gear is not a big factor for slow-moving aircraft, especially compared to the additional weight of retractable gear.
34. The fuel pump maintains a positive flow of fuel from the tank to the engine so the engine does not stall. The vent pipe prevents the tank from bursting when its pressure builds on a hot day. The fuel tank drain allows the removal of water from the tank that may have condensed from the air in the unfilled portion of the tank. The fuel strainer keeps any sediment from entering the fuel line that leads from the tank. The fuel selectors allow the pilot to manage what tank the fuel is coming from — helps keep the weight of the aircraft balanced.
35. T
36. F
37. T
38. F
39. T
40. cork
41. airspeed
42. attitude
43. engine, flight, navigational
44. mechanical, pressure, electrical
45. d
46. a
47. j
48. i
49. b
50. h
51. g
52. f
53. e
54. c
55. T
56. T
57. F
58. F
59. T

## Chapter 9

1. coordinates
2. vertical, horizontal, letters
3. intersection (coordinate point)
4. elevation
5. contour lines, color tints, shading
6. air, sectional (map)
7. small black circle
8. picks, sledge hammers
9. magenta
10. radio navigation
11. prohibited, restricted
12. Military Operations Area, military

13. training routes
14. true course, north (variation), deviation, altitude, airspeed, speed, direction
15. visible landmarks
16. true course, 10, checkpoints, course
17. dead reckoning
18. VOR, wind
19. nautical miles
20. thunderstorms
21. radio
22. stationary, rotating
23. b
24. c
25. b
26. a
27. T
28. T
29. F
30. F
31. T
32. T
33. T
34. F
35. F
36. T
37. T
38. T
39. T
40. F
41. Parallels = latitude; Meridian = longitude (only parallel at the equator)
42. The magnetic poles, north and south, are not co-located with the geographic poles.
43. Metals; electrical power; the compass, being mechanical will require adjustment
44. 6, 7, 5, 8, 4, 9, 3, 10, 2, 1
45. The master station and the slave station
46. Accelerometers, gyroscopes, and computers; it is self-contained and provides continuous information on the aircraft's position.
47. The military uses the Precise Positioning System (PPS); the civilian public uses the Standard Positioning System (SPS).
48. Instrument Landing System (ILS); Microwave Landing System (MLS); Differential GPS Landing System

## CHAPTER 10

1. a-8, b-4, c-1, d-2, e-6, f-5, g-3, h-7
2. Controlled, uncontrolled
3. Military
4. Blue
5. Approach
6. White

7. True
8. False
9. True
10. 26, 03, XX Left or XX Right or XX Center
11. Automated Terminal Information System; a voice recording telling pilots about local weather conditions, and runway restrictions; it allows the controller to direct their attention to controlling air traffic instead of filling the pilots in on local conditions.
12. Wildlife (usually birds) strikes, community encroachment, noise (abatement)

## CHAPTER 11

1. Boeing 747
2. A-300
3. Boeing 727
4. 70
5. a-2, b-3, c-1
6. short distances, speed
7. Boeing, McDonnell-Douglas, Lockheed
8. fares, routes
9. commuter, 20
10. T
11. T
12. F
13. F
14. T
15. They all fly on regular schedules and transport people or cargo as a commercial business.
16. It freed airlines from having to provide service to airports where little or no profit was made; helped the generation of new airlines to serve these smaller airports; increased competition among air carriers; helped to lower ticket prices.
17. They were suddenly faced with competition (their monopolies were eliminated); the newer airlines could charge lower fares, partly because their labor was not unionized and had lower pay, fuel prices tripled due to the energy crisis; high interest rates on newly purchased aircraft while newer airlines were flying used aircraft (lower purchase price and less interest); the recession of the late 1970s/early 1980s; the air traffic controllers strike
18. Airbus
19. Containers are easier to handle and load, and reduced losses from theft.

## CHAPTER 12

1. Ultralights
2. Cessna
3. FAA inspections, experimental aircraft
4. General Aviation
5. Fun or transporting family and friends, related to business

6. Small single engine aircraft
7. Cessna and Piper
8. Ultralights, soaring, ballooning, racing, gliding, aerobatics, homebuilts, antique aviation
9. True
10. True
11. True
12. False
13. False
14. Instructional, personal, sport, business and commercial aviation
15. Small, two-seater with small engines for a low cruising speed. They are very easy to fly (to build confidence in new pilots), inexpensive to buy, operate and maintain.
16. Four-place, single piston engine, fixed wing
17. Flying for fun or some other purpose than transportation or business (relaxation, hobby, competition, or thrill)

### CHAPTER 13

1. Air taxi/charter, pilot, aircraft, rental aircraft
2. peace of mind, reliability
3. Piper Malibu, pressurized
4. Air taxi/charter, transportation function
5. Agriculture applications, aerial advertising, aerial photography, fire fighting, fish & wildlife, patrol aircraft, industrial uses, industrial uses
6. True
7. True
8. True
9. True
10. False
11. The use of a private or company owned general aviation aircraft for business purposes
12. Who is flying the plane—business person for business and professional pilot for executive
13. Almost certainly a piston-powered aircraft with a 75% chance of being single engine, 4 seater, similar to a typical personal aircraft except better equipped so it can fly in bad weather
14. Usually twin engine, either turbine or piston powered
15. Fuel efficiency—high cost of fuel and potential shortages; Noise—limitations on it by the Federal Government and airports closed at night to jets due to noise; Cost Effectiveness—it is more effective to buy a plane that will cover the range of most of your travel and use the airlines for the longer, less frequent trips.
16. A segment of general aviation which deals with using general aviation aircraft for hire as a commercial business.

### CHAPTER 14

1. Heavier
2. A-10
3. F-117
4. E-3
5. S-3A
6. C-9A
7. c
8. b
9. d
10. c
11. Combat, noncombat, combat
12. Strategic, tactical
13. C-17
14. Bomber; Electronic attack-second in series; electronic fighter; experimental intended as bomber; cargo or passenger; reconnaissance fighter; tanker/cargo or passenger
15. Better training and better technology
16. False
17. False
18. True
19. True
20. False
21. Long term benefits of technology transfer among allies, a common use aircraft for NATO nations, increases the supply and availability of repair parts for the F-16 in Europe, and improves the F-16's combat readiness
22. The airplane dominates all aspects of warfare, control of the air is a prerequisite to winning on the ground as proven in wars since World War II

### CHAPTER 15

1. 4000
2. Hybrid, compound
3. STOL, VTOL
4. Vietnam
5. 50; 1500; 1500; 50
6. c
7. a
8. a
9. V-22 Osprey, hybrid, US Military
10. Newton's 3<sup>rd</sup> Law of Motion
11. Exhaust vectored downward, the entire propulsion unit turns
12. Lethal, nonlethal
13. True
14. False
15. True
16. False
17. False

## CHAPTER 16

1. CAB
2. FSS
3. NAFEC
4. NTSB
5. NASA
6. ICAO
7. Federal Aviation Agency, independent agency, Civil Aeronautics Administration, Commerce, safety regulations, enforcing, Federal Aviation Administration, Transportation
8. Air Traffic Control Tower, Air Route Traffic Control Center, positive control, Air Traffic Control Tower
9. Aircraft, airmen (or pilot, navigator, air traffic controllers, etc.), regulations, procedures
10. English
11. ICAO or International Civil Aviation Organization
12. Aircraft Owners and Pilots Association (AOPA)
13. Experimental Aircraft Association (EAA)
14. False
15. True
16. True
17. False
18. False
19. False
20. National Aviation Facilities Experiment Center; the FAA's research and development center; new types of airway navigational systems, a new instrument landing system, collision avoidance systems
21. Train personnel who operate the ARTCCs, FSSs, and airport control towers; train military and foreign controllers; train engineers and technicians who install and maintain the electronic equipment required for navigation, communication, and air traffic control; conduct initial and refresher training for their maintenance inspectors; develop examinations for airmen, airworthiness standards for aircraft, maintain records of airmen and aircraft.
22. National Transportation Safety Board; determining the cause or probable cause of any transportation accident
23. To explore, use, and enable the development of space for human enterprise; to advance scientific knowledge and understanding of the Earth, the solar system and the universe, and use the environment of space for research; to research, develop, verify, and transfer advanced aeronautics, space, and related technologies
24. Civil Reserve Air Fleet; allows DoD to use long-range jet transport aircraft belonging to the commercial airlines to move military equipment, cargo and personnel in times of national emergency or natural disaster on only 24 hours notice. The aircraft are supported by aircrews and maintenance personnel supplied by the airlines
25. Emergency Services—SAR missions for downed aircraft, lost outdoorsmen and children, disaster

relief, and emergency airlift of sick and injured as well as blood and transplant organs; Aerospace Education—for the membership and general public to develop awareness and appreciation for aerospace world we live in; Cadet Program—for young men and women 12-21 interested in aerospace and community service

## Chapter 17

1. is
2. institutes
3. two
4. formal technical education courses
5. voluntary
6. further training sponsored by the employer
7. d
8. a
9. c
10. d
11. b
12. aptitudes
13. occupation, aptitudes, succeed
14. Technical/vocational school
15. Terminal courses
16. Air Force Reserve Officer Training Corps
17. Professional Officers Course, General Military Course
18. Flight Instruction Program
19. True
20. True
21. False
22. False
23. False
24. It brought about change, it made it acceptable and popular to do research leading to the so-called knowledge revolution, the computer was developed to aid aerospace related industries, created a need for more and better trained people
25. It should be interesting, pleasant, provide satisfaction and self-respect, provide financial rewards

## Chapter 18

1. aerospace
2. heat, thermometer
3. precipitation, condensation
4. condensation nuclei, water vapor
5. evaporation
6. spread
7. Earth's, solar
8. heat balance
9. lateral
10. Coriolis effect
11. d

12. b
13. c
14. a
15. b
16. c
17. a
18. a
19. b
20. d
21. T
22. T
23. F
24. T
25. F
26. T
27. F
28. Humidity equals the amount of water vapor in the air. Relative humidity equals the amount of water vapor that can still enter the air mass before it becomes saturated.
29. Transformed — heat energy can be absorbed or reflected by clouds or dust in the atmosphere; it can be absorbed by the Earth and converted into heat energy. Transferred — conduction, convection, advection, radiation.
30. 64°F
31. **a.** A new car door makes an airtight seal. As the door is closed, air is compressed and can not escape. Thus, the door will not close securely because of greater pressure inside.  
**b.** The “pop” is caused by a tube behind the eardrum adjusting to the change in atmospheric pressure.  
**c.** When you punch one hole in the can, the liquid does not flow out readily because a partial vacuum is produced. When you punch a second hole, the air enters the top hole and the liquid flows out the bottom hole. No partial vacuum

## Chapter 19

1. c
2. a
3. b
4. d
5. f
6. e
7. h
8. g
9. weather
10. cumulus, stratus, cirrus
11. height (above the Earth’s surface)
12. rain, snow
13. winds
14. cumulonimbus
15. cirrus, cirrostratus, cirrocumulus

16. fog, stratus (could be answered stratus and stratocumulus)
17. d
18. c
19. a
20. T
21. F
22. F
23. T
24. T
25. F
26. T
27. F
28. F
29. It is safer to fly on the windward side which has little turbulence. The leeward side will most likely have the turbulent downdrafts.
30. None. The rotor clouds will form on the leeward side.

## Chapter 20

1. c
2. d
3. b
4. a
5. e
6. e
7. a
8. b
9. d
10. c
11. f
12. whiteout
13. cloud
14. blowing dust
15. hazardous (danger)
16. blowing sand
17. haze, smoke
18. blowing snow
19. towers
20. vortices
21. see
22. thunderstorm, cumulus
23. body, engine(s)
24. force, weather, uninhabitable
25. d
26. c
27. b
28. a
29. F
30. T
31. T
32. F

## CHAPTER 21

1. Gravity
2. Galileo
3. Galileo
4. Chinese
5. Goddard
6. World War I
7. 1-D, 2-C, 3-A, 4-B, 5-F, 6-E
8. 1-B, 2-C, 3-D, 4-A
9. B
10. C
11. C
12. D
13. Centrifugal effect
14. First, rest, motion, acted upon by some outside force
15. Third, an equal and opposite reaction
16. Riffling in the barrels
17. Payload
18. Liquid or solid
19. True
20. True
21. True
22. False
23. False
24. True
25. The first law means that, when launching the rocket vertically, the propulsion system must produce enough force (thrust) to overcome the inertia of the launch vehicle (i.e. greater than the weight of the rocket).  
The second law means that the amount of force required to accelerate a body is proportional to the mass of the body.  
The third law is at the heart of rocketry. Before launch, the rocket is stationary. The "action" is firing of the engines. Upon launch, liftoff is the equal and opposite reaction (movement in the direction opposite to the thrust)
26. Two bodies attract each other with a force directly proportional to their mass and inversely proportional to the square of the distance between them
27. Increase the mass of the exhaust or accelerate the exhaust particles to a higher velocity
28. It is the number of pounds of thrust delivered by consuming one pound of propellant (oxidizer/fuel mixture) in one second.

## CHAPTER 22

1. Oxidizer, chilled, liquid
2. Regressive
3. Mono-, bi-
4. Bi-propellant
5. Either (motor, solid) or (engine, liquid)

6. Slow
7. Oxidation, oxygen, another substance
8. Grain
9. Cryogenics
10. Nonhypergolic, hypergolic
11. Coupled valve, valves, crosshead, combustion chamber
12. c
13. d
14. 1-d, 2-c, 3-a, 4-b
15. True
16. False
17. True
18. False
19. False
20. It must contain oxidizer and fuel, ignite correctly every time, produce energy in the form of force, and that force must be controllable
21. By controlling the amount of the surface area exposed to the burning process
22. It is an enclosure filled with a combustible powder that is ignited electrically. The flame of the burning squib in turn ignites the grain of a solid propellant rocket.

## CHAPTER 23

1. East, 1000
2. sounding rocket
3. goes into higher orbit
4. retrothrust, slow down, gravity, faster
5. polar
6. a-2, b-7, c-5, d-8, e-6, f-1, g-3, h-9, i-4
7. velocity required for the payload to escape from the gravitational attraction of that planet.
8. Total Velocity Requirement
9. burnout, trajectory
10. the arc of a non-orbiting body
11. sounding rocket
12. transfer, coplanar transfer
13. minimum energy transfer
14. True
15. True
16. False
17. True
18. True
19. Due to the weakening of the Earth's gravitational effect with distance, although higher velocities are required to achieve the higher altitude.
20. The vehicle is first placed in a low-elliptical parking orbit. When it swings around to perigee, enough thrust is applied to push the vehicle to apogee at the desired altitude. When it reaches the high point of this transfer ellipse, thrust is again applied and the vehicle moves out on a circle that is tangent to the transfer ellipse.



## CHAPTER 24

1. a-1, b-3, c-5, d-2, e-4
2. a-3, b-4, c-5, d-1, e-2
3. interstellar
4. all
5. billion
6. three (actually 3.26)
7. four
8. 100
9. 100
10. cislunar space
11. space, 50, astronaut wings
12. space, 80, it's the point where an orbiting object will stay in orbit
13. Milky Way
14. light year, trillion.
15. 25, 40, 27
16. sunspot, 8, 15, 11
17. solar flare, 9, 15, 3 days
18. magnetosphere, solar winds, orbit of the moon.
19. cosmic rays, electrons, nuclei of atoms, solar winds
20. Van Allen belts, crescent, two, radiation
21. magnetic storms, radiation bursts, magnetic
22. scintillation, ionosphere
23. outgassing, vacuum
24. cold welding
25. differential charging
26. False
27. False
28. False
29. True
30. We get a global view of the earth, we can see the universe more clearly, potential for abundant resources (solar energy, minerals from other planets), a unique environment to make new materials not able to be developed on earth.
31. Powerful ultraviolet radiation of the sun and ultra-high frequency rays from the other stars
32. The sun
33. about 108 times as large as the earth; a giant thermonuclear reactor; gravity and energy emissions affect the whole solar system directly, magnetic field indirectly; average rotation time 27 days (varies between 25-40 depending on location on surface); sunspot cycle runs 8-15 years averaging 11 years; solar flares can hit earth within 9 minutes (low energy) or 15 minutes to 3 days for high energy particles)
34. Contains almost all its mass in a central nucleus ( a tight cluster of protons and neutrons) encircled by whirling negatively charged electrons.
35. An atom that carries a positive or negative charge from losing or gaining electrons

## Chapter 25

1. a
2. c
3. b
4. e
5. g (d, f, h)
6. d, f, h
7. b
8. b
9. c
10. a
11. b
12. e
13. d
14. f
15. a
16. c
17. g
18. 2.27, orbit
19. gravitational pull
20. 520
21. one, same
22. rilles
23. similar
24. deserts
25. photos
26. d
27. d
28. a
29. c
30. a
31. T
32. F
33. T
34. F
35. T
36. F
37. T
38. T
39. T

## CHAPTER 26

1. 1967 Outer Space Treaty
2. GPS
3. 1-c, 2-g, 3-f, 4-d, 5-i, 6-e, 7-h, 8-b, 9-a
4. 1-i, 2-j, 3-e, 4-d, 5-b, 6-k, 7-l, 8-c, 9-f, 10-g, 11-b, 12-a
5. probes, satellites
6. Sputnik; fly over countries without permission
7. passive, active
8. Selective Availability, Precise Positioning Service

9. Weather—A, C, E, G; Multi-Spectral Imaging—D, F; Reconnaissance—B
10. Geostationary Orbits (GEO), equal access for all
11. Bogata Declaration (1976), Geostationary Orbits (GEO)
12. Defense Meteorological Satellite Program, weather, military, optical, visual and infrared cloud
13. Orbital astronomy and environmental analysis
14. Placement of future space colonies.
15. d
16. c
17. d
18. b
19. True
20. False
21. True
22. False
23. Freedom of use—all nations should have access to space; Non-appropriation—no one owns any part of space; Use of space—since space belongs to all mankind, all nations should share its benefits
24. It documented the three principles of space law in written form and it legitimized a military presence in space by allowing military personnel to conduct scientific research
25. The ICBMs of the Superpowers could reach each other with mass destruction and Anti-Ballistic Missiles were under development to protect each nation, thereby increasing the likelihood of a first strike in nuclear war. To prevent this, both countries agreed not to develop ABM systems, including in space. The treaty is important because it specifies monitoring compliance from space, thus sanctioning monitoring other countries from space.
26. It formed NASA and defined civil and military responsibilities and provided a process for coordination between them.
27. It authorizes the military to provide facilities and support for commercial launches. The launch company only has to pay for the service while the military pays to maintain the facilities.
28. Manage the use of the station through consensus; each nation's own copyrights apply to creations of its citizens while aboard; and each nation decides whether the activities aboard their section are for peaceful purposes (allowing military members to serve)
29. Communication, navigation, observation, and scientific
30. Media transmission (radio and television), pure data transmission (Internet), personal communication (cellular phones), and providing links to other spacecraft
31. Satellites, which act as precise reference points; Control System, operated by USAF to adjust the satellite positions if necessary; Receivers, use the broadcast signal to calculate its position, velocity, time
32. Weather, Multi-Spectrum-Imaging, and Reconnaissance
33. Provide early warning by detecting enemy missile launch; detecting nuclear explosions; monitoring radio and radar transmissions; photo surveillance
34. Extensive materials processing and manufacturing can occur without polluting Earth's atmosphere, more unique and better products can be developed in space, could lead to human existence in other solar systems that do not have habitable planets, it's a new and different frontier

## Chapter 27

1. Apollo
2. Mercury
3. Gemini
4. 1-d, 2-c, 3-b, 4-a
5. John Glenn
6. Aleksei Leonov
7. Apollo 11, Neil Armstrong
8. Apollo-Soyuz
9. Space Transportation System
10. Enterprise
11. Columbia, Challenger, Discovery, Atlantis and Endeavour
12. Hubble Space Telescope
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